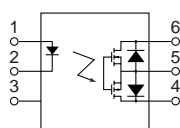
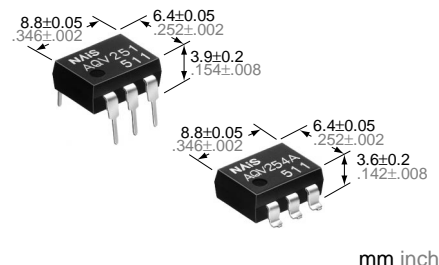


# NAIS

## HE (High-function Economy) Type [1-Channel (Form A) Type]

# PhotoMOS RELAYS



## FEATURES

1. Highly sensitive and low on-resistance
2. Controls various types of loads such as relays, motors, lamps and solenoids.
3. Optical coupling for extremely high isolation  
5,000 Vrms I/O isolation available.
4. Low-level off state leakage current
5. Eliminates the need for a power supply to drive the power MOSFET  
A power supply used to drive the power MOSFET is unnecessary because of the built-in optoelectronic device. This results in easy circuit design and small PC board area.
6. Low thermal electromotive force (Approx. 1  $\mu$ V)

## TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Data communication equipment

## TYPES

### 1. I/O isolation voltage: 1,500 V AC

Output rating*		Part No.				Packing quantity	
		Through hole terminal	Surface-mount terminal				
Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
				Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
40 V	500 mA	AQV251	AQV251A	AQV251AX	AQV251AZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
60 V	400 mA	AQV252	AQV252A	AQV252AX	AQV252AZ		
100 V	350 mA	AQV255	AQV255A	AQV255AX	AQV255AZ		
200 V	250 mA	AQV257	AQV257A	AQV257AX	AQV257AZ		
250 V	200 mA	AQV253	AQV253A	AQV253AX	AQV253AZ		
400 V	150 mA	AQV254	AQV254A	AQV254AX	AQV254AZ		
1,000 V	30 mA	AQV259	AQV259A	AQV259AX	AQV259AZ		
1,500 V	20 mA	AQV258	AQV258A	AQV258AX	AQV258AZ		

### 2. I/O isolation voltage: Reinforced 5,000 V

Output rating*		Part No.				Packing quantity	
		Through hole terminal	Surface-mount terminal				
Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
				Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
250 V	200 mA	AQV253H	AQV253HA	AQV253HAX	AQV253HAZ	1 tube contains 50 pcs.	1,000 pcs.
400 V	150 mA	AQV254H	AQV254HA	AQV254HAX	AQV254HAZ	1 batch contains 500 pcs.	

\*Indicate the peak AC and DC values.

Note: For space reasons, the package type indicator "X" and "Z" are omitted from the seal.

## RATING

## 1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Sym- bol	Type of connection	AQV251(A)	AQV252(A)	AQV255(A)	AQV257(A)	AQV253(A)	AQV254(A)	AQV259(A)	AQV258(A)	AQV253H(A)	AQV254H(A)	Remarks		
Input	LED forward current	I <sub>F</sub>		50 mA										f = 100 Hz, Duty factor +0.1%		
	LED reverse voltage	V <sub>R</sub>		3 V												
	Peak forward current	I <sub>FP</sub>		1 A												
	Power dissipation	P <sub>in</sub>		75 mW												
Output	Load voltage (peak AC)	V <sub>L</sub>		40 V	60 V	100 V	200 V	250 V	400 V	1,000 V	1,500 V	250 V	400 V	A connection: Peak AC, DC B, C connection: DC		
	Continuous load current	I <sub>L</sub>		A	0.5 A	0.4 A	0.35 A	0.25 A	0.2 A	0.15 A	0.03 A	0.02 A	0.2 A		0.15 A	
				B	0.7 A	0.6 A	0.45 A	0.35 A	0.3 A	0.18 A	0.04 A	0.025 A	0.3 A		0.18 A	
				C	1.0 A	0.8 A	0.70 A	0.5 A	0.4 A	0.25 A	0.05 A	0.04 A	0.4 A		0.25 A	
	Peak load current	I <sub>peak</sub>			1.8 A	1.5 A	1.0 A	0.75 A	0.6 A	0.5 A	0.09 A	0.06 A	0.6 A		0.5 A	A connection: 100 ms (1 shot) V <sub>L</sub> = DC
	Power dissipation	P <sub>out</sub>			360 mW											
Total power dissipation		P <sub>T</sub>	410 mW													
I/O isolation voltage		V <sub>iso</sub>	1,500 V AC										5,000 V AC			
Temperature limits	Operating	T <sub>opr</sub>	-40°C to +85°C -40°F to +185°F												Non-condensing at low temperatures	
	Storage	T <sub>slg</sub>	-40°C to +100°C -40°F to +212°F													

## 2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Sym- bol	Type of con- nection	AQV251(A)	AQV252(A)	AQV255(A)	AQV257(A)	AQV253(A)	AQV254(A)	AQV259(A)	AQV258(A)	AQV253H(A)	AQV254H(A)	Condition
Input	LED operate current	Typical	I <sub>Fon</sub>	—	0.9 mA								1.4 mA		I <sub>L</sub> = Max.	
		Maximum			3 mA											
	LED turn off current	Minimum	I <sub>Foff</sub>	—	0.4 mA										I <sub>L</sub> = Max.	
		Typical			0.8 mA								1.3 mA			
	LED dropout voltage	Typical	V <sub>F</sub>	—	1.14 V (1.25 V at I <sub>F</sub> = 50 mA)										I <sub>F</sub> = 5 mA	
Maximum		1.5 V														
Output	On resistance	Typical	R <sub>On</sub>	A	0.6 Ω	0.74 Ω	1.8 Ω	2.6 Ω	5.5 Ω	12.4 Ω	85 Ω	345 Ω	5.5 Ω	12.4 Ω	I <sub>F</sub> = 5 mA I <sub>L</sub> = Max. Within 1 s on time	
		Maximum			1 Ω	1.4 Ω	2.5 Ω	4 Ω	8 Ω	16 Ω	200 Ω	500 Ω	8 Ω	16 Ω		
		Typical	R <sub>on</sub>	B	0.3Ω	0.37 Ω	0.9 Ω	1.4 Ω	2.7 Ω	6.2 Ω	60 Ω	345 Ω	2.7 Ω	6.2 Ω	I <sub>F</sub> = 5 mA I <sub>L</sub> = Max. Within 1 s on time	
		Maximum			0.5 Ω	0.7 Ω	1.25 Ω	2 Ω	4 Ω	8 Ω	100 Ω	500 Ω	4 Ω	8 Ω		
		Typical	R <sub>on</sub>	C	0.15 Ω	0.18 Ω	0.45 Ω	0.7 Ω	1.4 Ω	3.1 Ω	30 Ω	160 Ω	1.4 Ω	3.1 Ω	I <sub>F</sub> = 5 mA I <sub>L</sub> = Max. Within 1 s on time	
		Maximum			0.25 Ω	0.35 Ω	0.63 Ω	1 Ω	2 Ω	4 Ω	50 Ω	250 Ω	2 Ω	4 Ω		
	Off state leak- age current	Maximum	—	—	1 μA						10 μA		1 μA		I <sub>F</sub> = 0 V <sub>L</sub> = Max.	
Transfer characteristics	Switch- ing speed	Turn on time*	T <sub>on</sub>	—	1.7 ms	1.4 ms	0.9 ms	1.5 ms	0.8ms	0.8ms	0.6ms	0.35 ms	2.4ms	1.8ms	I <sub>F</sub> = 5 mA I <sub>L</sub> = Max.	
		Maximum			3 ms		2 ms	3 ms	2 ms		1 ms		4 ms	3 ms		
		Turn off time*	T <sub>off</sub>	—	0.07 ms		0.09 ms	0.1 ms	0.06 ms	0.05 ms	0.04 ms		0.06 ms	0.05 ms	I <sub>F</sub> = 5 mA I <sub>L</sub> = Max.	
		Maximum			0.2 ms											
	I/O capaci- tance	Typical	C <sub>iso</sub>	—	1.3 pF										f ≈ 1 MHz V <sub>B</sub> = 0	
		Maximum			3 pF											
	Initial I/O isola- tion resistance	Minimum	R <sub>iso</sub>	—	1,000 MΩ										500 V DC	

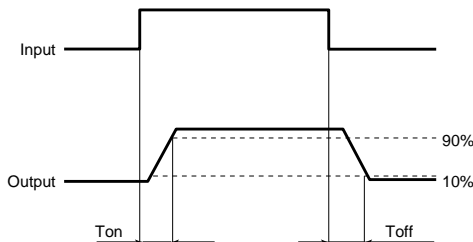
Note: Recommendable LED forward current

Standard type: 5 mA

Reinforced type: 5 to 10 mA

\*Turn on/Turn off time

For type of connection, see Page 31.



■ For Dimensions, see Page 27.

■ For Schematic and Wiring Diagrams, see Page 31.

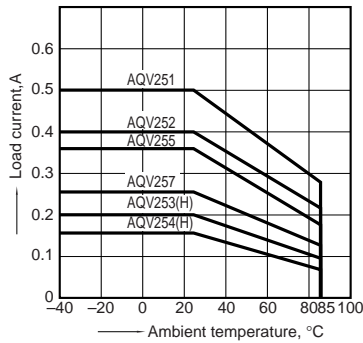
■ For Cautions for Use, see Page 36.

## REFERENCE DATA

### 1.-(1) Load current vs. ambient temperature characteristics

Allowable ambient temperature:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$   
 $-40^{\circ}\text{F}$  to  $+185^{\circ}\text{F}$  ;

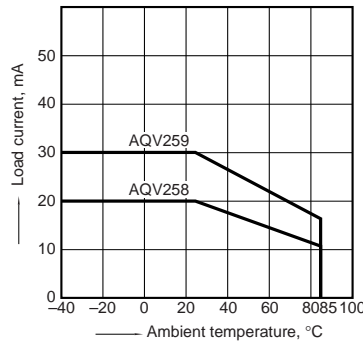
Type of connection: A



### 1.-(2) Load current vs. ambient temperature characteristics

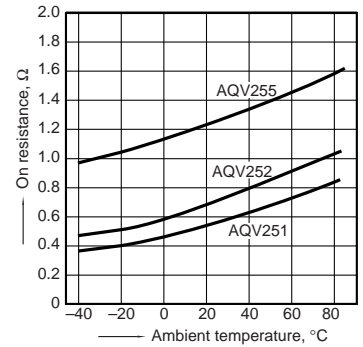
Allowable ambient temperature:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$   
 $-40^{\circ}\text{F}$  to  $+185^{\circ}\text{F}$  ;

Type of connection: A



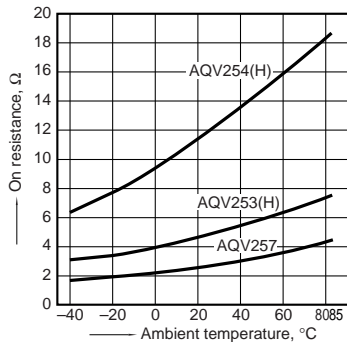
### 2.-(1) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;  
 LED current: 5 mA;  
 Continuous load current: Max. (DC)



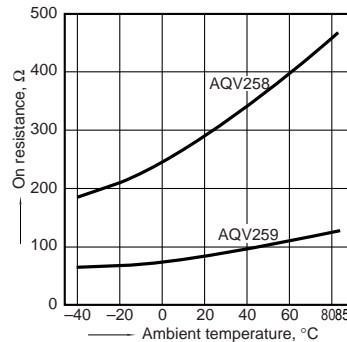
### 2.-(2) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;  
 LED current: 5 mA;  
 Continuous load current: Max. (DC)



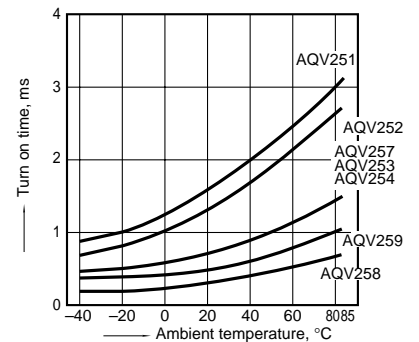
### 2.-(3) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;  
 LED current: 5 mA;  
 Continuous load current: 30 mA (DC)



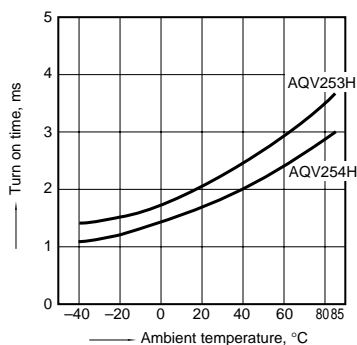
### 3.-(1) Turn on time vs. ambient temperature characteristics

LED current: 5 mA;  
 Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



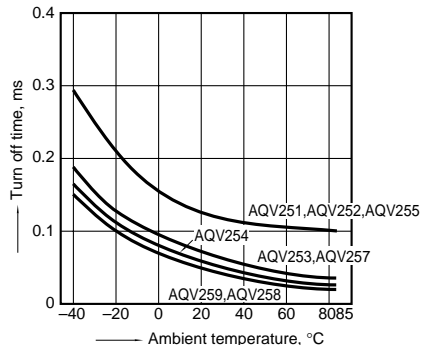
### 3.-(2) Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



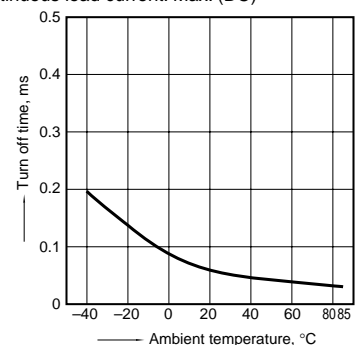
### 4.-(1) Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



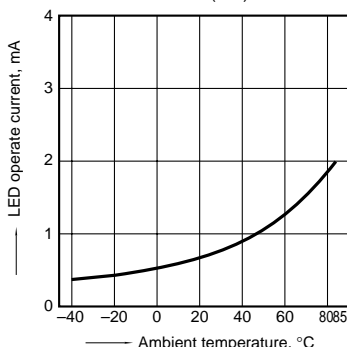
### 4.-(2) Turn off time vs. ambient temperature characteristics

Sample: AQV253H, AQV254H  
 LED current: 5 mA; Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



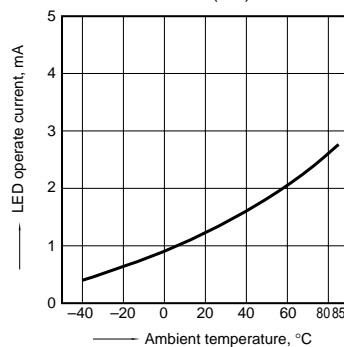
### 5.-(1) LED operate current vs. ambient temperature characteristics

Sample: AQV251, AQV252, AQV253, AQV254, AQV259; Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



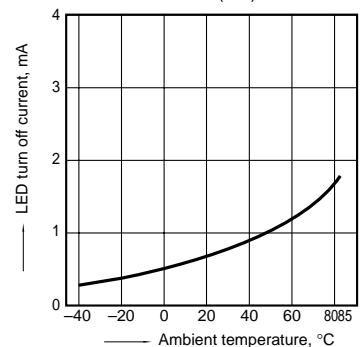
### 5.-(2) LED operate current vs. ambient temperature characteristics

Sample: AQV253H, AQV254H;  
 Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



### 6.-(1) LED turn off current vs. ambient temperature characteristics

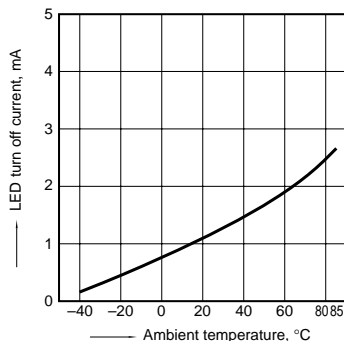
Sample: AQV251, AQV252, AQV253, AQV254, AQV259; Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



# AQV25○

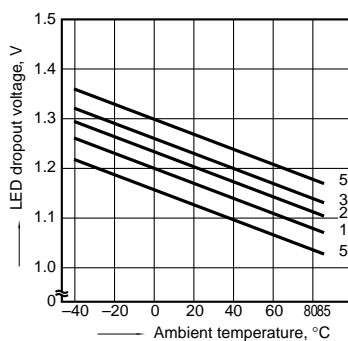
## 6.-(2) LED turn off current vs. ambient temperature characteristics

Sample: AQV251, AQV252, AQV253, AQV254, AQV259; Load voltage: Max. (DC); Continuous load current: Max. (DC)



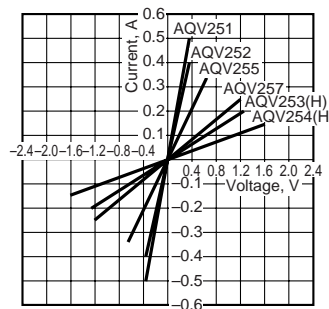
## 7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



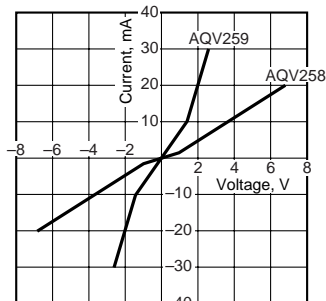
## 8.-(1) Voltage vs. current characteristics of output at MOS portion

Measured portion: between terminals 4 and 6; Ambient temperature: 25°C 77°F



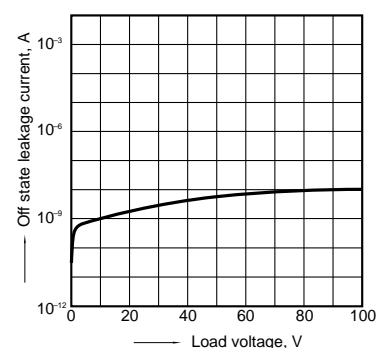
## 8.-(2) Voltage vs. current characteristics of output at MOS portion

Sample: AQV259; Measured portion: between terminals 4 and 6; Ambient temperature: 25°C 77°F



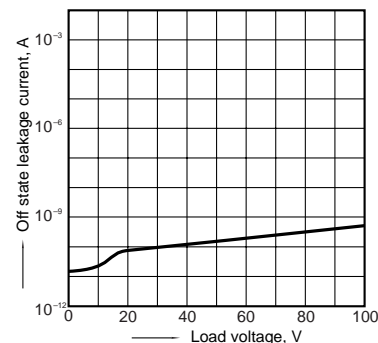
## 9.-(1). Off state leakage current

Sample: AQV259; Measured portion: between terminals 4 and 6; Ambient temperature: 25°C 77°F



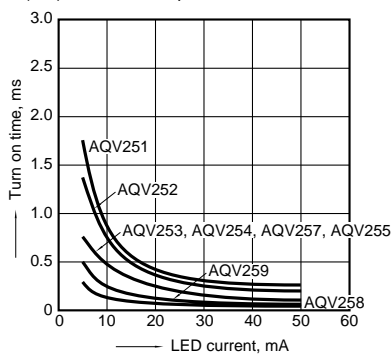
## 9.-(2). Off state leakage current

Sample: AQV254H; Measured portion: between terminals 4 and 6; Ambient temperature: 25°C 77°F



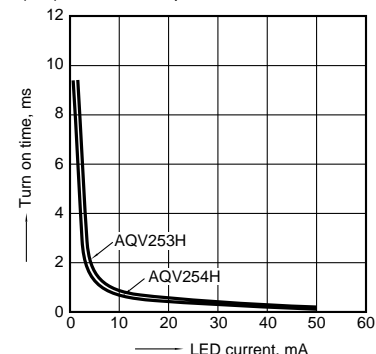
## 10.-(1). LED forward current vs. turn on time characteristics

Measured portion: between terminals 4 and 6; Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



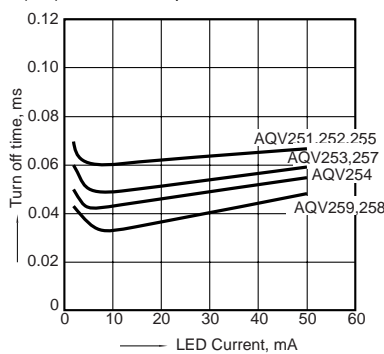
## 10.-(2). LED forward current vs. turn on time characteristics

Measured portion: between terminals 4 and 6; Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



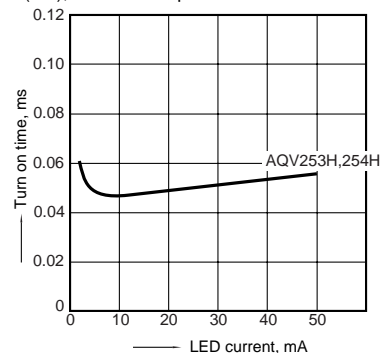
## 11.-(1). LED forward current vs. turn off time characteristics

Measured portion: between terminals 4 and 6; Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



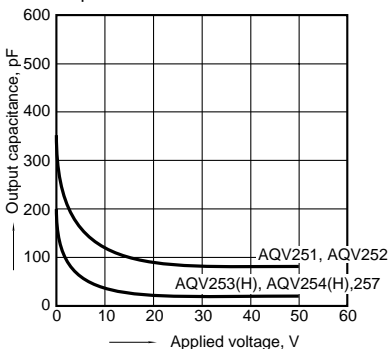
## 11.-(2). LED forward current vs. turn off time characteristics

Measured portion: between terminals 4 and 6; Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



## 12.-(1) Applied voltage vs. output capacitance characteristics

Measured portion: between terminals 4 and 6; Frequency: 1 MHz; Ambient temperature: 25°C 77°F



## 12.-(2) Applied voltage vs. output capacitance characteristics

Sample: AQV259; Measured portion: between terminals 4 and 6; Frequency: 1 MHz; Ambient temperature: 25°C 77°F

